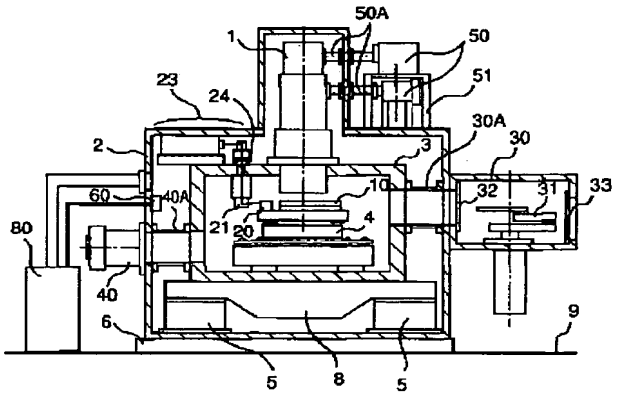
* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

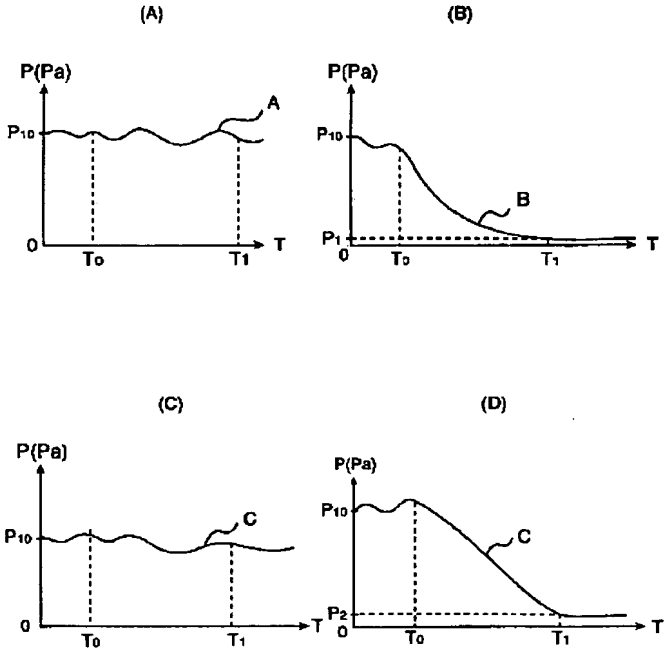
[Drawing 1]

図 1



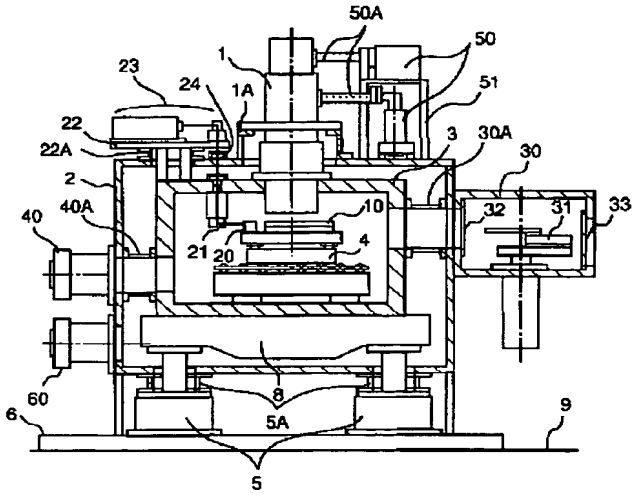
[Drawing 2]

図 2



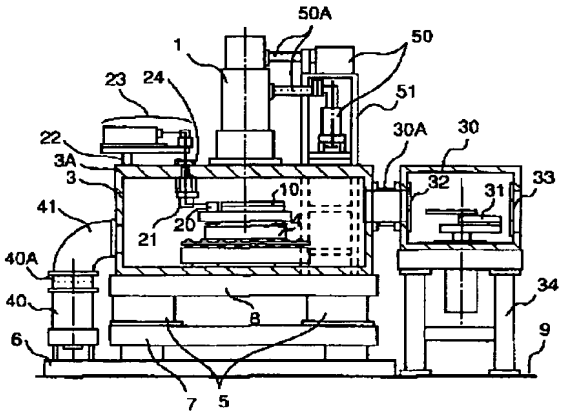
[Drawing 3]

図 3



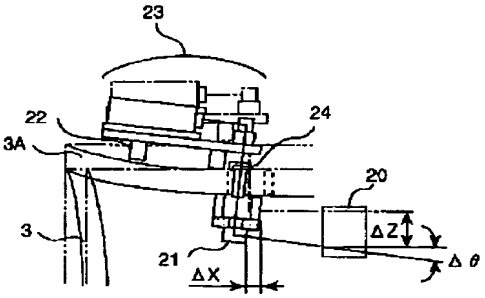
[Drawing 4]

図 4



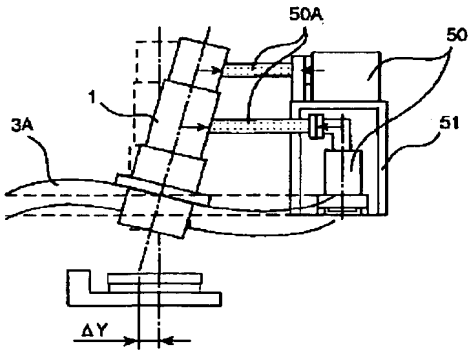
[Drawing 5]

図 5



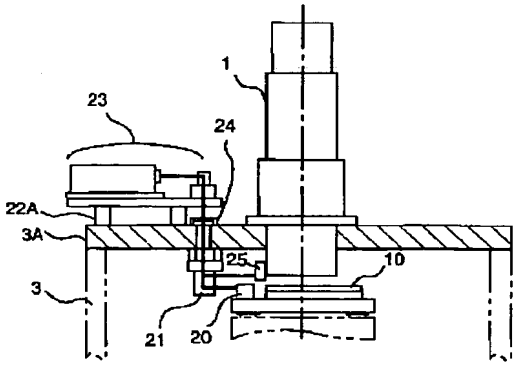
[Drawing 6]

図 6



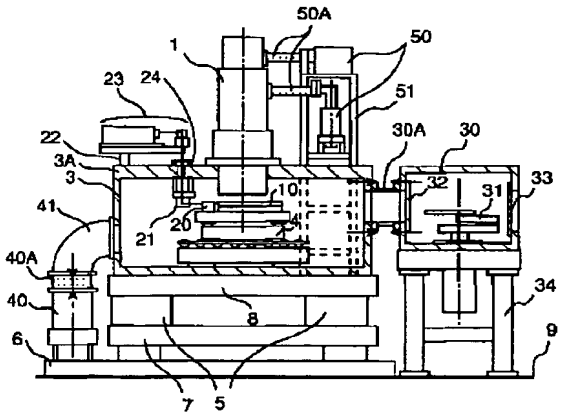
[Drawing 7]

図 7



[Drawing 8]

図 8



[Translation done.]

CLAIMS

[Claim(s)]

[Claim 1] The constant-pressure chamber characterized by having the vacuum pump which carries out said sample interior of a room to the constant-pressure chamber which surrounds a sample room at fixed vaccum pressure, and the pressure control means which adjusts the pressure of this interior established in said constant-pressure chamber so that the vaccum pressure of said sample interior of a room may be maintained uniformly.

[Claim 2] The constant-pressure chamber characterized by having the vacuum pump which carries out said sample interior of a room to the constant-pressure chamber which surrounds a sample room at fixed vaccum pressure, and the vacuum pump for constant-pressure chambers which decompresses the pressure of this interior established in said constant-pressure chamber to the pressure below an atmospheric pressure so that the vaccum pressure of said sample interior of a room may be maintained uniformly.

[Claim 3] Irradiation equipment using the constant-pressure chamber characterized by having the vacuum pump which carries out said sample interior of a room to the sample room which has in a sample an exposure means to irradiate energy, such as an electron, light, and laser, to a pattern, and the constant-pressure chamber which surrounds said sample room at fixed vaccum pressure, and the pressure control means which adjusts the pressure of this interior established in said constant-pressure chamber so that the vaccum pressure of said sample interior of a room may be maintained uniformly.

[Claim 4] While supporting the stage to which a sample is moved, the interferometer used for length measurement of a sample location with a laser beam faculty article, and the column which has the projection optics which processes a sample The constant-pressure chamber which surrounds the sample room which maintains the interior at fixed vaccum pressure with a vacuum pump, said sample room, and some columns, Irradiation equipment using the constant-pressure chamber and it which are

characterized by having the pressure control means which adjusts the pressure of this interior established in said constant-pressure chamber so that the vaccum pressure of said sample room may be maintained uniformly.

[Claim 5] While supporting the stage to which a sample is moved, the interferometer used for length measurement of a sample location with a laser beam faculty article, and the column which has the projection optics which processes a sample The constant-pressure chamber which surrounds the sample room which maintains the interior at fixed vaccum pressure with a vacuum pump, said sample room, and some columns, The constant-pressure chamber characterized by having the vacuum pump for constant-pressure chambers which decompresses the pressure of this interior established in said constant-pressure chamber to the pressure below an atmospheric pressure so that the vaccum pressure of said sample room may be maintained uniformly.

[Claim 6] Irradiation equipment using the constant-pressure chamber and it which are characterized by connecting between said sample rooms and constant-pressure chambers according to the linkage of elasticity in the publication of any 1 term of claims 1-5.

[Claim 7] Irradiation equipment using the constant-pressure chamber and it by which it is holding [connect by the linkage of elasticity between mounting which supports the surface plate surrounded by the constant-pressure chamber in the publication of any 1 term of claims 1-5 while laying said sample room, and said surface plate, and is prolonged in atmospheric air from a constant-pressure chamber, and a mounting edge and a constant-pressure chamber, and]-airtightly-these connection machine premises characterized.

[Claim 8] Irradiation equipment using the constant-pressure chamber and it which are characterized by surrounding mounting which supports the surface plate which lays said sample room in the publication of any 1 term of claims 1-5 by the constant-pressure chamber.

[Claim 9] Irradiation equipment using the constant-pressure chamber and it which are characterized by preparing the mechanical elastic body which produces the pressure which offsets the deformation of a sample room between said surface plates and mountings in claim 7.

[Claim 10] Irradiation equipment using the constant-pressure chamber and it which are characterized by forming the linear motor which has a fixed part and moving part between said surface plates and mountings in claim 7.

[Claim 11] Irradiation equipment using the constant-pressure chamber and it which are characterized by being supported by said sample room, and arranging optical-system

components and a column on the outside of a constant-pressure chamber in the publication of any 1 term of claims 1-5, connecting between said column and optical-system components, and constant-pressure chambers by the linkage of elasticity, and holding the inside of this linkage airtightly.

[Claim 12] Irradiation equipment using the constant-pressure chamber and it which are characterized by surrounding the column supported by said sample room, projection optics, or a reflecting optical system by the constant-pressure chamber in the publication of any 1 term of claims 1-5.

[Claim 13] Irradiation equipment using the constant-pressure chamber and it which are characterized by having connected the exhaust air path of said column, projection optics, or a reflecting optical system through the linkage of elasticity in claim 7.

[Claim 14] Irradiation equipment using the constant-pressure chamber and it which are characterized by establishing the linkage of elasticity between said sample rooms and constant-pressure chambers, and maintaining the inside of a constant-pressure chamber airtightly while supporting supporter material for the laser beam faculty article arranged in an atmospheric-air ambient atmosphere by said sample room in the publication of any 1 term of claims 1-5 and surrounding this supporter material.

[Claim 15] Irradiation equipment using the constant-pressure chamber and it which are characterized by being the sample conveyance path and sample room exhaust air path which connect between said constant-pressure chambers and said sample rooms by the linkage of elasticity, and open between a constant-pressure chamber and said sample rooms for free passage within this connection machine enclosure in the publication of any 1 term of claims 1-5.

[Claim 16] Irradiation equipment using the constant-pressure chamber and it which open between said sample rooms and spare rooms for free passage according to the linkage of elasticity, and are characterized by this free passage hole being a sample conveyance path and a sample room exhaust air path in the publication of any 1 term of claims 1-5.

[Claim 17] Irradiation equipment using the constant-pressure chamber and it which are characterized by supporting the vacuum pump which makes a vacuum the inside of the column which has equipment which irradiates an electron ray at said sample in the publication of any 1 term of claims 1-5 to a constant-pressure chamber, and establishing the linkage of low rigidity between a column and a vacuum pump.

[Claim 18] The sample room uniformly maintained in internal vaccum pressure with the pressure in said constant-pressure chamber in the publication of any 1 term of claims 1-5, Or it is the sample room uniformly maintained in internal vaccum pressure

with the pressure decompressed in the pressure in said constant-pressure chamber by the pressure below atmospheric pressure. The manufacturing installation of the circuit pattern characterized by being equipment which irradiates a charged-particle line, an X-ray, a contraction X-ray (EUV), etc. at the sample of said sample interior of a room, and forms a circuit pattern in a sample.

[Claim 19] The sample room uniformly maintained in internal vaccum pressure with the pressure in said constant-pressure chamber in the publication of any 1 term of claims 1-5, Or it is the sample room uniformly maintained in internal vaccum pressure with the pressure decompressed in the pressure in said constant-pressure chamber by the pressure below atmospheric pressure. Test equipment of the circuit pattern characterized by being equipment which irradiates a charged-particle line, an X-ray, a contraction X-ray (EUV), etc. at the sample of said sample interior of a room, and inspects the engine performance of a circuit pattern.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to a vacuum chamber, irradiation equipment, the manufacturing installation of a circuit pattern, or the test equipment of a circuit pattern.

[0002]

[Description of the Prior Art] In the equipment which manufactures or inspects circuit patterns which form a circuit pattern in the circuit pattern of the magnetic head or a semiconductor device, and a semiconductor device, such as a mask and a reticle, irradiating a charged-particle line or a contraction X-ray (EUV) at these samples, and manufacturing or inspecting a circuit pattern is conducted. As for an electron ray, at this time, being used in a vacuum is indispensable also in a charged-particle line.

[0003] Moreover, use of the short X-ray of wavelength and a contraction X-ray is considered from excimer laser with detailed-izing of a circuit pattern, and this contraction X-ray also has [among a vacuum whenever / low-vacuum] use indispensable [the light source of the contraction projection aligner called a stepper and a scanner] in an ambient atmosphere.

[0004] Hereafter, the electron-beam-lithography equipment which draws a circuit

pattern in a sample, using an electron ray as an example is explained.

[0005] Electron-beam-lithography equipment is equipment which forms an LSI pattern on the glass base called the reticle used for a semi-conductor base top or aligners, such as a stepper, by generated and scanning an electron ray in the environment of an ultra-high vacuum.

[0006] The configuration of conventional electron-beam-lithography equipment is shown in drawing 4 .

[0007] In drawing 4 , the electron ray emitted within the column 1 is irradiated by the sample 10 laid in the stage 4 in the sample room 3. A sample location is managed by carrying out laser length measurement of the mirror 20 on a stage 4. In atmospheric air, laser arranges the interferometer 21 in a vacuum in order to tend to receive effect in the fluctuation of air, and change of an atmospheric pressure.

[0008] Moreover, since he wants to measure a sample location on the basis of a column 1, it has been attached in the lid 3A inferior surface of tongue of the sample room 3 which is comparatively easy to synchronize with a column 1. The sample room 3 is laid on a surface plate 8, and a surface plate 8 is supported by the mounting 5 which has the function of vibration isolation.

[0009] Furthermore, the body stand 7 holding mounting 5 is arranged on the base 6 installed in the floor 9. Evacuation of the column 1 is carried out by the vacuum pump 50 for columns, and the internal ambient atmosphere is maintained at the high vacuum (for example, 10 - 4 or less Pa). Moreover, evacuation of the sample room 3 is carried out by the vacuum pump 40 for sample rooms, and it is maintaining the internal ambient atmosphere at the high vacuum (for example, 10-4Pa base).

[0010] Next, the conveyance path of a sample 10 is explained.

[0011] A sample 10 is conveyed in the reserve exhaust room 30 from the exterior which is an atmospheric-air ambient atmosphere by the transport device 31 in the reserve exhaust room 30 which adjoins the sample room 3, and preliminary exhaust air is carried out from an ambient condition with the vacuum pump which is not illustrated to a vacua. When it becomes a degree of vacuum comparable as the sample room 3, a bulb 32 is opened, and a sample 10 is conveyed on a stage 4. After drawing serves as a reverse path, returns an ambient atmosphere to atmospheric air from a vacuum within the reserve exhaust room 30, and conveys it to the exterior.

[0012] By actuation of a top Norikazu ream, while the sample room 3 has been a vacua, conveyance of a sample is attained, and improvement in a throughput is measured. Moreover, if a transport device and a bulb are operated during drawing, vibration which leads to degradation of drawing precision will occur. For this reason, vibration is

insulated by the sample room 3 and reserve minding [30] bellows 30A for reserve exhaust rooms which is the connection member of low rigidity (elasticity), and conveyance actuation under drawing is enabled. Moreover, in order that vibration of the vacuum pump 40 for sample room exhaust air may have a bad influence on drawing precision similarly, bellows 40A for sample room exhaust air is minded between the sample rooms 3.

[0013] On the other hand, through bellows 50A for column exhaust air, it connects with the column 1 and the vacuum pump 50 for column exhaust air is held with the stand 51 supported by the surface plate 8.

[0014] Although it is necessary with electron-beam-lithography equipment to maintain the path of an electron ray at a high vacuum in order to prevent the energy loss of an electron ray, as mentioned above, the following troubles are mentioned in the conventional equipment configuration.

(1) The sample of the increment recent years of a length measurement error, especially a wafer are diameter[of macrostomia]-ized in order to raise productivity, and they are making the number of chip acquisition per sheet increase. It is necessary to also enlarge the stroke of the stage to which a sample is moved, and, for this reason, a sample room is also enlarged inevitably. The area of the sample room which receives vacuum negative pressure increases by this, and the following error factors are collected in addition in the conventional equipment configuration.

[0015] The sample room 3 will deform with vacuum negative pressure, the location of the interferometer 21 attached in the sample room 3 in connection with it and an optic 23 will change, and a length measurement error will be produced. Drawing 5 shows change of the laser beam study system by deformation of the sample room 3, drawing 6 shows the situation of the deformation (falling) by the vacuum negative pressure when carrying out evacuation of the column 1, and the following errors will produce it.

i) If the length measurement error interferometer 21 by displacement deltaX of an interferometer carries out deltaX displacement, an error will join [delta X] the information on the sample location of column criteria.

ii) If the length measurement error column 21 by deformation deltaY of a column does deltaY displacement of, an error will join [deltaY] the information on the sample location of column criteria.

iii) After the Abbe error interferometer 21 by displacement deltaZ of an interferometer has done deltaZ displacement of, when pitching of a stage thetap Arises, the following length measurement errors are produced.

[0016] If the cosine error interferometer 21 by rotation deltatheta of delta Z-sinthetapiv

interferometer does deltatheta rotation of, the following length measurement errors will be produced.

[0017]

L (1-cosdeltatheta) L: Although the approach of making rigidity of a sample room high is raised as an approach of reducing the error of the measurement die-length above, the increment in the load to mounting accompanying the increment in mass of a sample room is not avoided.

[0018] Although the proofreading approaches, such as measuring an error beforehand and giving correction value to control on the other hand, can be considered, since atmospheric pressure changes with time amount, it cannot be proofread with fixed correction value, amendment of real time is needed, and the system of equipment becomes very complicated.

[0019] Moreover, like [error / of Above i and ii] drawing 7 , although it is possible to be making reference light of an interferometer 21 into the structure which irradiates the reference mirror 25 in which it was attached by the column 1, and to decrease, optical-axis adjustment becomes complicated and working hours increase it.

(2) If the effect reserve exhaust room 30 to a mounting property, and the vacuum pump 40 for sample room exhaust air and the sample room 3 are connected by linkage of low rigidity like bellows, the pressure which is proportional to the area of bellows as seemingly shown by the arrow head of drawing 8 to the sample room 3 under the effect of vacuum negative pressure will be added. Therefore, the vacuum negative pressure resulting from bellows 30A for reserve exhaust rooms and the vacuum negative pressure resulting from bellows 40A for sample room exhaust air act on mounting 5.

[0020] It can be considered seemingly that these loads are the sample room 3, the reserve exhaust room 30, and the compressive force committed between bellows 40A for sample room exhaust air. Since it is necessary to hold a transport device 31 and the relative position of a stage 4 in order to secure the conveyance precision of a sample, the mounting 5 which supports the sample room 3 must generate force which is negated to such compressive force.

[0021]

[Problem(s) to be Solved by the Invention] However, when designing mounting in consideration of such compressive force, it is difficult to grasp the effect on the control characteristic by compressive force. There are JP,1-28669,Y and JP,2001-210576,A as a solution about this technical problem. These attach cancellation devices, such as a pneumatic spring, near the bellows which connects a reserve exhaust room and a sample room, and the approach of offsetting the compressive force committed in a

reserve exhaust room and a sample room is indicated.

[0022] By these approaches, the force which a cancellation device generates will be added to a direct sample room, and a sample room will be distorted. Consequently, a relative displacement arises in the interferometer and column which are attached in the sample interior of a room, and the length measurement error of a measuring instrument arises. Although a length measurement error can be proofread about the case where atmospheric pressure is fixed, as mentioned above, when atmospheric pressure is changed, amendment of real time is needed, the system of equipment becoming complicated and the circuit pattern drawn on the sample is inaccurate, and the yield of a sample is bad.

[0023] The above troubles are the same also in the test equipment using the aligner using the test equipment which is not restricted to electron-beam-lithography equipment, but uses the charged-particle line using an electron ray in a vacuum or an X-ray, and a contraction X-ray or an X-ray, and a contraction X-ray.

[0024] The purpose of this invention is offering the constant-pressure chamber which improved the yield of the sample which corrected the measurement error of an instrumentation and formed the pattern.

[0025]

[Means for Solving the Problem] It is characterized by establishing the pressure control means maintained by the pressure which the interior surrounded the sample room which has fixed vaccum pressure by the constant-pressure chamber by this invention as a solution over the above-mentioned technical problem, adjusted so that the vaccum pressure of a sample room might be uniformly maintained by the constant-pressure chamber in the pressure in a constant-pressure chamber, or was decompressed from atmospheric pressure.

[0026] That is, the stage to which a sample is moved is connoted, the interferometer used for length measurement of a sample location is attached, the sample room which maintains the interior at fixed vaccum pressure is surrounded by the constant-pressure chamber in support of a column, projection optics, or a reflecting optical system, and the pressure control means which adjusts the pressure in a constant-pressure chamber so that the vaccum pressure of the sample interior of a room may be maintained uniformly is constituted.

[0027] Or the stage to which a sample is moved is connoted, the interferometer used for length measurement of a sample location is attached, a column, projection optics, or a reflecting optical system is supported at a sample room, vaccum pressure of the sample interior of a room is fixed with a vacuum pump, and the pressure control means which

adjusts the inside of a constant-pressure chamber so that the vaccum pressure of a sample room may be maintained uniformly is established and constituted in a constant-pressure chamber.

[0028]

[Embodiment of the Invention] Hereafter, in order to make an understanding of the operation gestalt of this invention easy, it explains from the configuration of the electron-beam-lithography equipment shown in drawing 1 as the 1st example.

[0029] In drawing 1 , the constant-pressure chamber 2 is arranged on the base 6, and the surface plate 8 which put the sample room 3 on the interior is supported by mounting 5. The stage 4 in which a sample 10 is laid is carried in the sample room 3, and the column 1 is supported to the sample room 3 upper parts. An interferometer 21 is attached in the sample room 3, and the laser beam faculty article 23 is attached in the sample room 3, and is constituted. The pressure in the constant-pressure chamber 2 is controlled based on the information on the pressure sensor 60 attached in the wall to become a fixed pressure by the pressure control means 80.

[0030] About the pressure control means 80, actuators for fluids, such as a gas exhaust air pump, a leak bulb for atmospheric-air installation, and an air compressor, and the information on a pressure sensor 60 are incorporated, and it is constituted by the control section which gives a feedback signal to each actuator.

[0031] In the reserve exhaust room 30 attached in the constant-pressure chamber 2, the transport device 31, the bulb 32, and the bulb 33 for atmospheric air possess, and it connects with the sample room 3 through bellows 30A for reserve exhaust rooms.

[0032] Moreover, the vacuum pump 40 for sample room exhaust air attached in the constant-pressure chamber 2 is connected with the sample room 3 through bellows 40A for sample room exhaust air. The column 1 supported by the sample room 3 is included by the constant-pressure chamber 2, and between a column 1 and the vacuum pumps 50 for column exhaust air is connected by bellows 50A for column exhaust air.

[0033] Next, the description of this configuration is explained.

[0034] The description of this structure is that the ambient atmosphere in the sample room 3, the ambient atmosphere in the constant-pressure chamber 2, and the atmospheric ambient atmosphere are isolated. The effectiveness taken below by this to two items (effect on a length measurement error and a mounting property) which became a problem with the conventional configuration is acquired.

[0035] With the mitigation book configuration of a length measurement error, the vacuum negative pressure which joins the sample room 3 is prescribed by the pressure in the constant-pressure chamber 2, the differential pressure in the sample room 3, and

the surface area of the sample room 3. Therefore, if the pressure in the constant-pressure chamber 2 is controlled by the almost same magnitude (about 10000Pa) as atmospheric air, a sample room will produce deformation equivalent to the conventional configuration.

[0036] However, by the pressure control means 80, the sample location which expected the length measurement error to the control section of the equipment which controls a pressure and is not illustrated is proofread so that deformation of the sample room 3 may be reduced for the pressure in a constant-pressure chamber. After proofreading is not concerned with fluctuation of an atmospheric pressure, but since the pressure of the inside [of the constant-pressure chamber 2] and sample interior of a room is uniformly held by proofreading, it stops easily being able to transform a column 1, an interferometer 21, and laser beam faculty article 23 grade, and highly precise drawing of it is attained by it at a sample 10.

[0037] Moreover, if the pressure in the constant-pressure chamber 2 is maintained at a low vacuum (for example, about 10Pa), since it will become 1/1000 of atmospheric pressure (about 10000Pa), the vacuum negative pressure which joins the sample room 3 and a column 1 can be reduced to 1/1000 compared with the conventional configuration. Therefore, even if it does not proofread the sample location which expected the length measurement error to the control section of equipment, the sample room 3 and the length measurement error resulting from deformation of a column 1 are reduced sharply.

[0038] That is, drawing 2 explains the reason for the ability to reduce a length measurement error sharply. Drawing 2 is the property Fig. showing the relation between atmospheric-pressure [of an axis of ordinate] P (Pa), and the time amount T of an axis of abscissa. This drawing (A) is property Fig. A of atmospheric pressure P10 (1000Pa), this drawing (B) is the vaccum pressure property B in the sample room 3, and this drawing (C) is pressure-characteristics Fig. C in the constant-pressure chamber 2.

[0039] It follows on passing from the start time T0 which started the drive of a vacuum pump 50 in time amount T, and started the vacuum suction in the sample room 3, and the vacuum property B becomes the fixed vaccum pressure value P1 (ten to 4 Pa). This vaccum pressure value P1 is called a calibration value T1 or a reference value. Since it is abbreviation regularity, even if the sample room 3 deforms the vaccum pressure of a calibration value T1, it is maintained in the state of fixed deformation. While the vaccum pressure of the sample room 3 adjusts the pressure in a constant-pressure chamber for maintaining uniformly and maintaining the fixed deformation condition of the sample room 3 by the pressure control means 80, in a calibration value T1, it proofreads as a reference value of the measuring instrument of a column 1, an

interferometer 21, and laser beam faculty article 23 grade.

[0040] Consequently, by the vaccum pressure of the sample room 3 adjusting the pressure in a constant-pressure chamber for maintaining uniformly, and maintaining the fixed deformation condition of the sample room 3, there is little deformation of the sample room 3, rigidity of the sample room 3 can be made small, the sample room 3 can be made thin, it can be made light, or only the part which prepared the constant-pressure chamber can make it cheap. Moreover, since deformation of the sample room 3 was held with the small vaccum pressure value, deformation could be still smaller, and its length measurement error could decrease, it can draw a pattern now on a sample 10 correctly, and its yield of the sample in which the pattern was formed improved sharply.

[0041] Furthermore, a pattern can be formed in a sample 10 for a calibration value T1 as a reference value of the measuring instrument of a column 1, an interferometer 21, and laser beam faculty article 23 grade. The length measurement error of a pattern decreased and the yield of the sample 10 which came to be able to carry out things and formed the pattern further which draws a pattern on a sample 10 correctly improved sharply.

[0042] Moreover, since this was used as a reference value when determining the calibration value T1, a calibration value did not need to be changed one by one like before, modification with a measuring instrument etc. was lost, and measurement became easy.

2) The vacuum negative pressure of the unloading sample room 3 to mounting, the reserve exhaust room 30 opened for free passage with Bellows 30A and 40A, and the vacuum pump 40 for sample room exhaust air is prescribed by the pressure in the sample room 3, and the differential pressure in the constant-pressure chamber 2 and the area of each bellows. When the pressure in the constant-pressure chamber 2 is atmospheric pressure extent, the vacuum negative pressure which acts on mounting 5 is magnitude comparable as the conventional configuration.

[0043] However, the magnitude of the vacuum negative pressure which acts to mounting 5 decreases proportionally by decompressing the pressure in the constant-pressure chamber 2 below to atmospheric pressure. For example, if the pressure in a constant-pressure chamber is maintained at a low vacuum (for example, about 10Pa) from the pressure of the sample room 3, compared with the conventional configuration, it becomes 1/1000 of vacuum negative pressure, and by the time it hardly affects the control characteristic of mounting 5, it will decrease.

[0044] About mounting used into such a low vacuum, the mechanical elastic bodies,

such as a spring without risks, such as leakage of a fluid, fit mounting as a pressure receiving medium rather than mounting whose pressure receiving medium and controlled medium use fluids, such as air. moreover, the direction of an actuator mechanical as a controlled medium -- mounting -- it is easy, and since especially a linear motor has moving part and a non-contact fixed part, its controllability is good.

[0045] Moreover, the following effectiveness is mentioned except the improvement effect of the above 2.

[0046] In the conventional configuration shown in drawing 5 , it had attached in the stand 51 supported by the surface plate 8 so that vibration of the vacuum pump 50 for column exhaust air might not be told to the direct sample room 3. In this case, the stand for pump maintenance is enlarged and the increment list of cost has many demerits, such as an increment in a mounting tooth space.

[0047] A vacuum pump with comparatively little vibration like an ion pump needed to be adopted to support a direct vacuum pump in a sample room conventionally. However, exhaust velocity of an ion pump is small and it has the fault to which the time amount which starts a column to a high vacuum becomes long.

[0048] With the configuration of this invention, since bellows 30for reserve exhaust rooms A and the bellows 40A and 50A for vacuum pumps connect, the sample room 3 and the constant-pressure chamber 2 are mostly insulated in vibration. Therefore, not only an ion pump but a turbo molecular pump also with a comparatively large vibration etc. can be directly supported from the constant-pressure chamber 2, and compaction of the makeup time by reduction of stand manufacture cost, the insulation of vibration, and use of a turbo molecular pump can be attained to coincidence.

[0049] That is, by the pressure control means 80, as shown in drawing 2 (B), in order to hold the vaccum pressure value P1 with the fixed inside of the sample room 3, as shown in drawing 2 (D), the pressure in the constant-pressure chamber 2 is decompressed to the pressure P2 not more than atmospheric pressure P10 (Pa) so that the vaccum pressure value P1 of the sample room 3 may be maintained uniformly.

[0050] Since what is necessary is to use only a reduced pressure pump, without a pressure P2 needing a booster pump compared with atmospheric pressure P10 with the pump which there is little fluctuation of pressure characteristics C and is used for the pressure control means 80 when it does so, the configuration of the pressure control means 80 can be simplified. Moreover, compared with the case where the stress which joins the bellows 30A and 40A which open between the sample room 3 and the constant-pressure chambers 2 for free passage uses an atmospheric pressure P10, only the part which became small can prolong the life of Bellows 30A and 40A. The value of a

pressure P2 is 10-minute one or less magnitude of the value in atmospheric pressure P10. With one [or less / 10-minute], fluctuation of pressure characteristics is good only with a reduced pressure pump few.

[0051] In addition, in the example 1, since electron-beam-lithography equipment was made into the example, it was written as the column, but in equipments, such as a stepper and a scanner, if the equipment which irradiates energy, such as electrons, such as projection optics or catoptric system, and light, is replaced with a column and considered, the same effectiveness will be acquired. Hereafter, the same is said of the 2nd example and 3rd example.

[0052] Next, the 2nd example shown in drawing 3 is explained.

[0053] Although the ambient atmosphere from atmospheric pressure to a low vacuum was assumed for the pressure in the constant-pressure chamber 2 in the 1st example, it has the composition of having assumed the ambient atmosphere below a low vacuum, in the 2nd example.

[0054] Hereafter, the equipment which used the constant-pressure chamber 2 is explained.

[0055] On the base 6, the mounting 5 which supports a surface plate 8 is arranged, and the sample room 3 is laid on a surface plate 8. Susceptor 22 is attached in the sample room 3, and the laser beam faculty article 23 is arranged on susceptor 22. Moreover, the constant-pressure chamber 2 is supported on the base 6, and it connects with a column 1, mounting 5, and susceptor 22 through bellows 1for columns A, bellows 5for mounting A, and bellows 22A for susceptors respectively. Evacuation of the constant-pressure chamber 2 is carried out by the vacuum pump 60 for constant-pressure chambers, and the interior becomes possible [maintaining at the ambient atmosphere from a low vacuum to a high vacuum].

[0056] Here, the description of this configuration is explained.

[0057] With this configuration, in order to keep efficient the pressure in the constant-pressure chamber 2 in the ambient atmosphere where a degree of vacuum is comparatively high, the volume in the constant-pressure chamber 2 is stopped. In the example 1, although a column 1, mounting 5, and the laser beam faculty article 23 were arranged in the constant-pressure chamber 2, at this example, they can be arranged in atmospheric air and an internal pressure can be decompressed comparatively easily by connecting with the constant-pressure chamber 2 with bellows respectively.

[0058] Since the effectiveness of this configuration just maintains the pressure in the constant-pressure chamber 2 below at a low vacuum (for example, 1Pa or less), it has attached the vacuum pump 60 for constant-pressure chambers instead of the pressure

control means 80 which was explained in the example 1.

[0059] If the ambient atmosphere in the constant-pressure chamber 2 can be decompressed below to a fixed pressure by this, it will be there being no need of carrying out feedback control of the vacuum pump, and being able to reduce sharply the effect on a length measurement error and a mounting property.

[0060] However, since a column 1, mounting 5, and the laser beam faculty article 23 are in atmospheric air, vacuum negative pressure joins [the surface integral of bellows 1for columns A connected with the constant-pressure chamber 2, bellows 5for mounting A and bellows 22A for susceptors] the sample room 3. Therefore, in order to make deformation of a sample room small, it is necessary to make area of each bellows as small as possible. Moreover, the vacuum negative pressure to the column 1 by the vacuum pump 50 for column exhaust air needs to make high rigidity of the anchoring section of a column and a sample room, in order to suppress deformation (falling) of a column, since it is the same as the conventional configuration.

[0061] On the other hand, about mounting 5, since it is in atmospheric air, there is no constraint in a pressure receiving medium and an actuator, and fluids, such as air, can be used.

[0062] About the 3rd example, when using a sample at a sample room and using one piece or a a small number of individual in an experiment etc., a sample room is surrounded by the constant-pressure chamber, a sample may be supplied and discharged with the bellows prepared between the sample room and the constant-pressure chamber, or a sample may be beforehand arranged to the sample interior of a room.

[0063] Thus, in the example of this invention, a column is irradiation equipment which irradiates energy, such as an electron ray, light, and laser, at a sample. They are the above-mentioned electron-beam-lithography equipment, laser-beam-machining equipment, and an aligner as irradiation equipment. Highly precise exposure or inspection is possible for this equipment. Moreover, in using a sample at a sample room and using one piece or a a small number of individual in an experiment etc., it does not necessarily need a reserve exhaust room.

[0064]

[Effect of the Invention] As mentioned above, according to this invention, the vaccum pressure of a sample room can adjust the pressure in a constant-pressure chamber for maintaining uniformly, and the fixed deformation condition of a sample room can be maintained. Thereby, a pattern can be correctly drawn now on a sample and the yield of the sample in which the pattern was formed improves sharply as there is little

deformation of the sample room 3. Furthermore, since the calibration value was used as a reference value, the proofreading activity with a measuring instrument etc. became easy.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The side elevation of the electron-beam-lithography equipment which used the constant-pressure chamber concerning the example 1 of this invention.

[Drawing 2] The pressure-characteristics Fig. showing the pressure in the electron-beam-lithography equipment of drawing 1 , and the relation of time amount.

[Drawing 3] The side elevation of the electron-beam-lithography equipment which used the constant-pressure chamber concerning the example 2 of this invention.

[Drawing 4] The side elevation showing the electron-beam-lithography equipment of the conventional example.

[Drawing 5] The explanatory view showing the trouble in the electron-beam-lithography equipment of drawing 4 .

[Drawing 6] The explanatory view showing the trouble in the electron-beam-lithography equipment of drawing 4 .

[Drawing 7] The explanatory view showing the trouble in the electron-beam-lithography equipment of drawing 4 .

[Drawing 8] The side elevation of the electron-beam-lithography equipment which used the sample room of the conventional example.

[Description of Notations]

1 [-- Sample room,] -- A column, 1A -- The bellows for column exhaust air, 2 -- A constant-pressure chamber, 3 3A [-- Bellows for mounting,] -- A lid, 4 -- A stage, 5 -- Mounting, 5A 6 [-- A floor, 10 / -- A sample, 20 / -- Mirror,] -- The base, 7 -- A body stand, 8 -- A surface plate, 9 21 [-- Laser beam faculty article,] -- An interferometer, 22 -- Susceptor, 22A -- The bellows for susceptors, 23 24 -- Transmitting glass, 25 -- A reference mirror, 30 -- Reserve exhaust room, 30A [-- Atmospheric-air bulb,] -- The bellows for reserve exhaust rooms, 31 -- A transport device, 32 -- A bulb, 33 34 [-- Piping, 50 / -- The vacuum pump for column exhaust air, 50A / -- The bellows for column exhaust air, 51 / -- A stand, 60 / -- A pressure sensor, 70 / -- A vacuum-pump frame-common-equipment base 80 / -- Pressure control means.] -- A reserve exhaust room frame-common-equipment base, 40 -- The vacuum pump for sample room exhaust air, 40A -- The bellows for sample room exhaust air, 41